

Upper Nine Miles of the Lower Passaic River Draft Interim Remedy Feasibility Study Summary for Community Advisory Group

The following summary of the draft Interim Remedy (IR) Feasibility Study (FS) for the upper nine miles of the Lower Passaic River Study Area (LPRSA) is provided to the Passaic River Community Advisory Group to aid the group in preparing its submission to the Contaminated Sediments Technical Advisory Group/National Remedy Review Board (CSTAG/NRRB). Since the IR FS report is still being reviewed by the EPA, the information in this summary is current as of October 11, 2019. As work on the IR FS progresses, the information will be updated and modified. This document should not be relied on as a summary of the final IR FS. EPA and the partner agencies have a number of comments on the draft FS and this summary is taken from the draft FS directly without the comments addressed. In addition, the IR FS will not be finalized until the CSTAG and NRRB provide EPA Region 2 with their recommendations.

Interim Remedy Background

A group of potentially responsible parties named the Cooperating Parties Group (CPG) is performing the remedial investigation (RI)/FS for the 17-mile LPRSA (from Newark Bay to the Dundee Dam), under EPA oversight. The CPG collected sediment, surface water, and tissue samples and performed multiple bathymetric survey events between 2007 and 2013. The human health risk assessment (HHRA) and baseline ecological risk assessment (BERA) were approved by EPA and the RI report was conditionally approved by the EPA, awaiting finalization of the bioaccumulation model. The CPG's 17-mile RI/FS schedule projected the FS completion date for calendar year 2025, with a final Record of Decision (ROD) likely by 2028. According to this proposed schedule, the in-river remedial action work would begin in 2031 and be completed by 2035, followed by post-remedial action monitoring.

The data collected as part of the RI allowed EPA to identify areas of sediment in the upper 9-mile reach that are considered contaminant source areas. The sediment source areas are areas with elevated contaminant concentrations that are a significant source to the local biota, that contribute sediment contamination to the water column and throughout the river, and that inhibit recovery of the system. In 2017, the CPG proposed moving away from the original 17-mile schedule and evaluating an IR for sediment source control. EPA projects that if an IR for sediment source control is selected, the schedule could be adjusted to have a ROD for an IR in 2021 and implementation of the IR between 2024 and 2028, followed by some years of post-IR monitoring, development of risk-based remedial goals (RGs), and a final ROD. Under the IR schedule, the in-river work in the upper nine miles would coincide with the in-river work in the lower 8.3 miles, which would take advantage of cost efficiencies while the infrastructure constructed for the lower 8.3-mile remedy is in place, as well as reduce the disruption in the river and to the many communities along the river while resulting in an overall faster recovery of the river.

Remedial Action Objectives

The objective of the IR is to remove sediment sources. The EPA determined that for this IR in the upper 9 miles of the LPRSA, a surface-weighted average concentration (SWAC)-based goal would be used to determine if the sediment sources have been removed. A SWAC demonstrates the average concentration of a certain contaminant. For example, the SWACs in the upper 9 miles of the river are currently at 932 parts per trillion (ppt) for 2,3,7,8-TCDD (dioxin) and 2 parts per million (ppm) for total polychlorinated biphenyls (PCBs). The way to achieve a SWAC is to remove all contaminated sediment greater than a certain level, also known as a remedial action level (RAL). The first step of this IR is to collect a large amount of sediment data in what will be called a pre-design investigation (PDI). This data will be used to identify the sediment sources (sediment with concentrations greater than the RALs) and ultimately, removal of the sediment sources would leave behind sediment with SWACs equal to or less than 85 ppt for dioxin and 0.46 ppm for total PCBs (see below). EPA has memorialized this concept through two remedial action objectives (RAOs) that would be achieved through the implementation of the IR:

RAO 1—Addressing Surface Sediment Source Areas

- Control the sediment sources of dioxin and total PCBs by remediating surface sediment source areas containing elevated concentrations, thereby reducing the SWACs of dioxin and total PCBs from river mile (RM) 8.3 to RM 15. Achieve a post-IR dioxin SWAC from RM 8.3 to RM 15 of not more than 85 ppt, approximately an order of magnitude higher than the Operable Unit 2 (i.e., the lower 8.3 miles of the LPRSA) dioxin sediment remediation goal of 8.3 ppt, and achieve a post-IR total PCB SWAC from RM 8.3 to RM 15 that is at or below the established total PCB background concentration of 0.46 ppm.

RAO 2—Addressing Subsurface Sediment Source Areas

- Control subsurface sediments (sediments deeper than 6 inches below the sediment bed) from becoming sources of dioxin and total PCBs by remediating sediments between RM 8.3 and RM 15 that have a demonstrated potential for erosion to expose subsurface concentrations above the defined subsurface RALs established for dioxin and total PCBs.

The IR focuses on addressing areas of elevated dioxin and total PCB concentrations. However, other contaminants of concern would be addressed by the IR to the extent they are located together. All site risks would be addressed through the final ROD, which would identify risk-based RGs and would be developed after implementation of the IR and post-IR monitoring.

As part of the IR FS, an Adaptive Management Plan provides a management framework for interpreting and responding to new data and changed site conditions. This framework would ensure that data collected during the monitoring phases of the project would be used to reduce site uncertainties and establish an efficient and protective final remedy for the LPRSA. The Adaptive Management Plan defines how key project uncertainties would be managed and how recovery and system response would be integrated into a structured decision framework to ensure that the goal of protecting human health and the environment is achieved. For instance,

the Adaptive Management Plan includes an approach to use monitoring data to refine uncertainty within the site models being used to project recovery to ensure that the models represent the river accurately.

Remedial Alternatives

The IR FS develops and evaluates a set of remedial alternatives to address sediment sources in the upper 9 miles of the LPRSA. The set of IR FS remedial alternatives is as follows:

- Alternative 1: No further action
- Alternative 2: Remediate sediment from RM 8.3 to RM 15 to attain a post-IR dioxin SWAC of 85 ppt and PCB RAL of 1 ppm¹
- Alternative 3: Remediate sediment from RM 8.3 to RM 15 to attain a post-IR dioxin SWAC of 75 ppt and PCB RAL of 1 ppm
- Alternative 4: Remediate sediment from RM 8.3 to RM 15 to attain a post-IR dioxin SWAC of 65 ppt and PCB RAL of 1 ppm
- Alternative 5: Remediate sediment from RM 8.3 to RM 15 to attain a post-IR dioxin SWAC of 125 ppt²

The difference between each alternative is basically the size of the footprint of contaminated sediment to be remediated. Throughout the IR FS, Alternatives 2, 3, 4, and 5 are referred to as the active alternatives since Alternative 1 does not require any action. However, as can be seen below and in footnote 1, Alternative 5 would not attain the IR RAOs and is evaluated for comparison reasons only.

The IR FS considers different types of response actions and technologies for addressing the sediment sources in the upper 9-miles including no further action, institutional controls (ICs), natural recovery, in-situ sediment treatment (activated carbon amendment), ex-situ sediment treatment (soil washing, stabilization, thermal treatment), containment (capping), sediment removal (dredging/excavation), transportation (of removed sediment and capping material), disposal, and beneficial use.

There are a number of common elements that apply to the active alternatives:

- Sediment removal: for each active alternative, source area sediment would be removed through dredging and some limited amount of land-based excavation; dredge depths are anticipated to be 2-3 feet
- Dredged material management: dredged sediment would be processed at an off-site

¹ The remedial action objective of 0.46 ppm for PCBs is the background (equivalent to the target SWAC) and 1 ppm is the remedial action level to achieve that SWAC

² Alternative 5 is included in the IR FS for comparison purposes only. Alternative 5 would not attain the two IR RAOs, and is not eligible for selection as the EPA's preferred alternative. However, this alternative would yield a smaller remedial footprint that would not address as much sediment as Alternative 2, 3, or 4, and the inclusion of this alternative provides a stronger basis in the IR FS for comparative evaluation of Alternatives 2, 3, and 4.

- sediment processing facility to prepare it for disposal
- Residuals management: best management practices would be used to minimize the generation and movement of residuals from dredging
- Capping: for each active alternative, the area dredged/excavated would be capped to restore the pre-dredge grade; although the footprint size differs, the type of cap would not change between alternatives
- Monitoring and ICs: all alternatives would require monitoring and ICs such as fish advisories

All of the active alternatives would impact the river habitat, which would be mitigated by approximately restoring habitat to avoid loss of ecological function and habitat area. There would be construction constraints associated with the active alternatives, including low bridges that could affect access and the presence of sensitive infrastructure. Some aspects of the IR would be further evaluated in the remedial design after a preferred alternative is selected. For instance, while it is assumed in the IR FS that mechanical dredging/excavation would be implementable for the entire upper 9-mile reach to perform the IR, the remedial design may take alternative sediment removal approaches into consideration where there is sensitive infrastructure. Table 1 provides a summary of the IR FS alternatives with respect to several key characteristics.

Evaluation of Remedial Alternatives

Each alternative is evaluated in the IR FS according to the 9 remedy evaluation criteria specified by EPA and the National Contingency Plan. Each alternative must meet two threshold criteria—overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs)—to be eligible for selection as EPA’s preferred alternative. Five balancing criteria are then applied as a framework to assess tradeoffs among the alternatives with respect to long-term effectiveness and permanence; reduction in contaminant toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost of each alternative. The final two criteria (modifying criteria) address state and community acceptance.

Threshold Criteria

The two threshold criteria address overall protection of human health and the environment and compliance with ARARs. Alternatives are evaluated against the following specific IR FS metrics for these criteria:

1. Overall protection of human health and the environment
 - a. Ability to progress towards overall protection
 - b. Ability to achieve RAOs
2. Compliance with ARARs
 - a. Ability to achieve ARARs

The threshold criteria are evaluated based on the specifications of each remedial alternative:

- Can meet criterion—the alternative is capable of meeting the threshold criterion

- Does not meet criterion—the alternative is incapable of meeting the threshold criterion

Primary Balancing Criteria

The five balancing criteria represent the primary basis for the detailed and comparative analysis of alternatives in the IR FS. The balancing criteria are summarized below, along with the metrics that are applied in the IR FS to weigh the alternatives against the criteria.

Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of a remedial alternative addresses the degree of risk reduction it achieves and the adequacy and reliability of its environmental controls. To evaluate long-term effectiveness and permanence, the following four IR metrics are assessed: source control; cap stability; monitoring, maintenance, and institutional controls; and recovery potential.

Reduction of Toxicity, Mobility, or Volume through Treatment

The main elements of the remedial alternatives are removal, processing, and disposal of contaminated sediment and capping. For each active alternative, the IR FS also looks at *ex-situ* treatment during sediment processing, and *in-situ* treatment through the addition of an organic carbon amendment to the capping material. The degree of achievement of this criterion is determined for each alternative based on the volume of removal, contaminant mass removed, and area capped.

Short-Term Effectiveness

The metrics used to evaluate short-term effectiveness are time to achieve RAOs, worker risks and community impacts, resuspension, and potential for contaminant transport during construction.

Implementability

A qualitative evaluation of remedy implementability includes the technical feasibility of and need for best management practices and monitoring, construction challenges, potential challenges due to availability of materials, consideration of future use, and potential administrative matters and challenges. Lessons learned from early actions in the LPRSA are reviewed, specifically feasibility impacts due to numerous utility crossings, shoreline structures, bridge pilings, and transport of equipment and materials up and down the river.

Cost

Feasibility-level cost estimates are developed and compared for each alternative. The cost estimates include capital costs and annual and periodic monitoring and maintenance costs for 10 years post-remedy.

Modifying Criteria

Modifying criteria are state acceptance and community acceptance, which may be used to modify aspects of the preferred alternative when preparing the ROD. EPA is required to consider state and community concerns in its evaluation of state and community acceptance in the ROD, following the public comment period on EPA's proposed plan.

Table 2 demonstrates how the IR alternatives are assessed in the IR FS against the criteria in comparison to each other. EPA has several comments on this table; it should be considered draft but may assist the CAG in demonstrating how the alternatives can be balanced against the criteria and each other. As can be seen from Table 2, for instance, alternatives 1 and 5 do not meet both threshold criteria. Figures 1 through 7 below demonstrate a visual/graphical form of the comparative analysis that is summarized in Table 2. EPA created these graphics, using information presented in the IR FS and Table 2, to assist the CAG in evaluating the comparative analysis of IR alternatives.

TABLES AND FIGURES

TABLE 1 - SUMMARY OF KEY CHARACTERISTICS OF IR ALTERNATIVES

Alternative	Dioxin RAL (ppt)	PCB RAL (ppm)	Post-IR Dioxin SWAC (ppt) and % Reduction from Current	Post-IR PCB SWAC (ppm) and % Reduction from Current	Area of Remediation Footprint (acres)	Volume of Dredged Sediment (cy)	Construction Duration (years)	Cost (\$Million)
1	--	--	932 (0%)	2 (0%)	0	0	--	0
2	260	1	80 (91%)	0.44 (78%)	90	363,000	4.3	412
3	205	1	70 (92%)	0.41 (80%)	96	387,000	4.6	433
4	165	1	60 (94%)	0.39 (81%)	104	419,000	4.9	460
5	346	--	121 (87%)	0.62 (69%)	62	250,000	3.2	314

-- not applicable (for Alternative 1, no action would be taken; for Alternative 5, the PCB RAL is not applied because applying the PCB RAL would yield a remediation footprint that is too similar to the other active alternatives to provide a meaningful basis of comparison)

cy – cubic yards

ppm – parts per million

ppt – parts per trillion

RAL – remedial action level

SWAC – surface-weighted average concentration

TABLE 2 – SUMMARY OF COMPARATIVE ANALYSIS OF IR ALTERNATIVES

Key Metrics Summary	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Explanation of Ranking
Dioxin SWAC achieved (ppt) ¹	--	80	70	60	121	
Total PCB SWAC achieved (ppm)	--	0.44	0.41	0.39	--	
Area of removal (acres)	--	90	96	104	62	
Volume of removal (cubic yards)	--	363,000	387,000	419,000	250,000	
Mass of 2,3,7,8-TCDD removed (grams)	--	800	820	840	700	
Mass of total PCBs removed (kilograms)	--	1,090	1,120	1,150	800	
Construction duration (years)	--	4.3	4.6	4.9	3.2	
1. Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	No	Yes = achieves the metrics for this threshold criterion (achieves the RAOs, and progress towards overall protection of human health and the environment). No = does not achieve the metrics for this threshold criterion.
2. Compliance with ARARs	Yes	Yes	Yes	Yes	Yes	Yes = meets this threshold criterion.
3. Long-Term Effectiveness and Permanence	--	✓✓✓	✓✓✓	✓✓✓	✓✓	A higher ranking (more checks) indicates the degree to which this balancing criterion is achieved based on the sub-metrics.
<i>Source Control</i>	--	✓✓✓	✓✓✓	✓✓✓	✓	A higher ranking (more checks) indicates the degree to which sources are addressed. • Dependent on the RAL.
<i>Cap Stability</i>	--	✓✓✓	✓✓✓	✓✓✓	✓✓✓	The active alternatives achieve a stable cap to the same degree. • Identical cap design criteria.
<i>Monitoring, Maintenance, and Institutional Controls</i>	--	✓✓✓	✓✓✓	✓✓✓	✓✓	The active alternatives require the same degree of monitoring and maintenance; a higher ranking (more checks) indicates the possibility that institutional controls (specifically fish consumption advisories) may be revised when remedial goals are achieved. • Dependent on the RAL.

Key Metrics Summary	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Explanation of Ranking
<i>Recovery Potential</i>	--	✓✓✓	✓✓✓	✓✓✓	✓	A higher ranking (more checks) indicates a higher potential for recovery following source control. <ul style="list-style-type: none"> Dependent on the RAL.
4. Reduction of Toxicity, Mobility, or Volume through Treatment	--	✓✓	✓✓✓	✓✓✓✓	✓	A higher ranking (more checks) indicates a higher volume of sediment that is addressed through reduction of mobility and treatment. <ul style="list-style-type: none"> Dependent on contaminant mass removed.
5. Short-Term Effectiveness	✓	✓✓✓✓	✓✓✓	✓✓	✓	A higher ranking (more checks) indicates the degree to which this balancing criterion is achieved based on the sub-metrics.
<i>Time to Achieve RAOs</i>	--	✓✓✓	✓✓✓	✓✓✓	--	It is assumed that post-construction certification process will take approximately 3 years, and Alternatives 2, 3, and 4 will achieve the RAOs 7-8 years following the start of construction. Alternatives 1 and 5 do not achieve RAOs. <ul style="list-style-type: none"> Dependent on duration.
<i>Worker Risk and Community Impact</i>	✓✓✓✓✓	✓✓✓	✓✓	✓	✓✓✓✓	A higher ranking (more checks) indicates higher performance, i.e., lower risk and impact. <ul style="list-style-type: none"> Dependent on duration.
<i>Resuspension</i>	--	✓✓	✓✓	✓✓	✓✓	The projections of the active alternatives show approximately the same level of resuspension. <ul style="list-style-type: none"> Dependent on the contaminant mass removed.
<i>Downstream and upstream transport</i>	--	✓✓	✓✓	✓✓	✓✓	The projections of the active alternatives show approximately the same level of transport. <ul style="list-style-type: none"> Dependent on the contaminant mass removed.
6. Implementability	✓✓✓✓✓	✓✓✓	✓✓	✓	✓✓✓✓	A higher ranking (more checks) indicates more implementable. <ul style="list-style-type: none"> Dependent on volume dredged.
7. Cost (\$M)	5.7	412	433	460	314	<ul style="list-style-type: none"> Dependent on volume dredged.
Overall Summary	✓	✓✓✓✓	✓✓✓	✓✓	✓	

¹ Based on the approach to deriving remedial footprints in the IR FS (i.e., including additional area to attain RAO2 after the footprint already attains RAO1), the actual anticipated post-IR SWAC for each active alternative is lower than the SWAC targeted by the alternative.

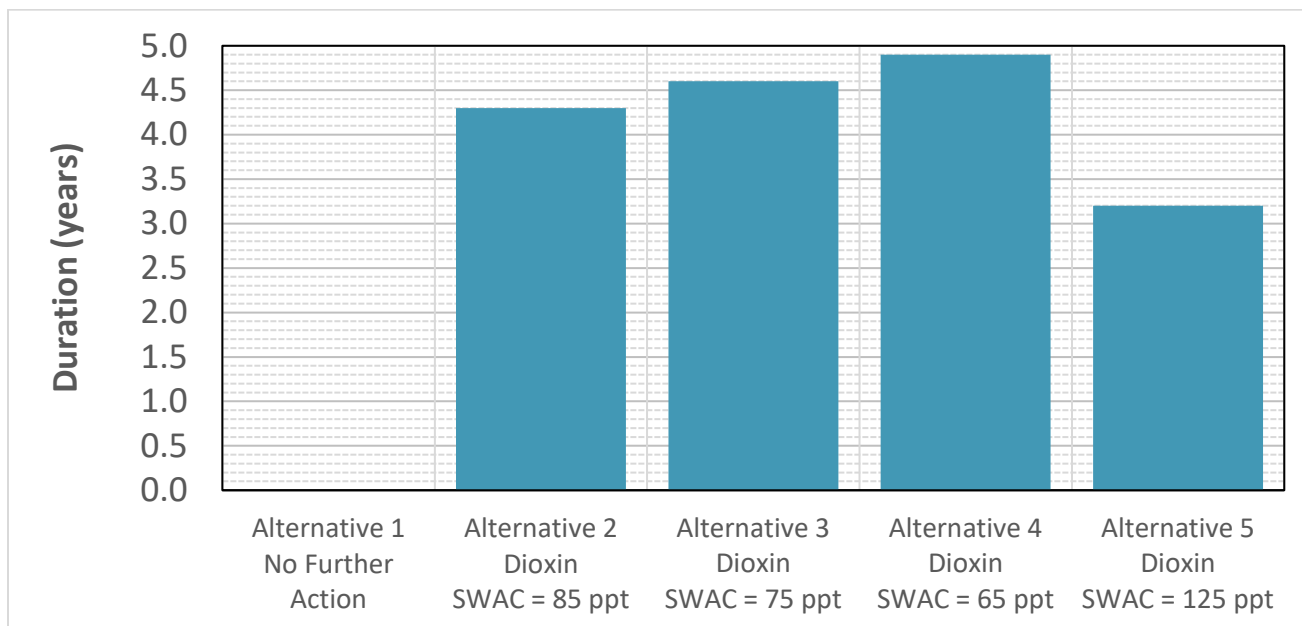


Figure 1. Remedy Duration in Years: Community construction impacts will increase with increasing duration, as well as any worker risks related to the duration of construction. Duration for Alternatives 2 through 4 ranges from 4.3 to 4.9 years, respectively. Duration is closely related to volume dredged.

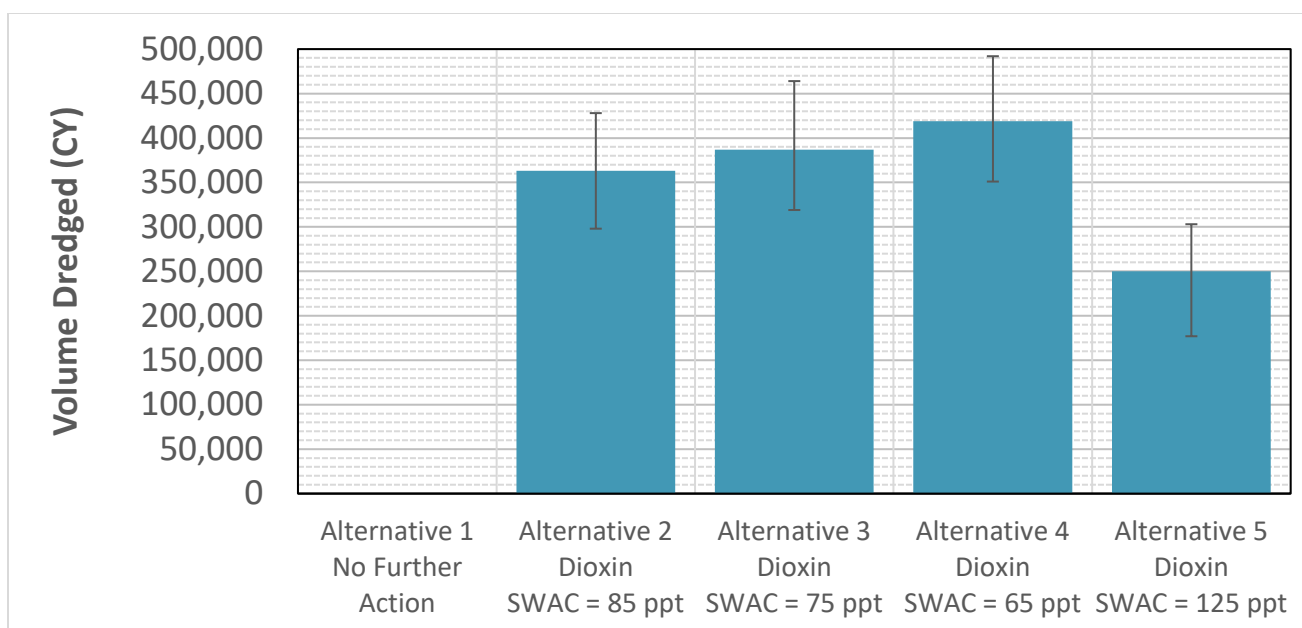


Figure 2. Volume Dredged in Cubic Yards (CY): Implementability decreases with larger volumes, and cost increases with larger volumes. Volume dredged for Alternatives 2 through 4 ranges from 363,000 to 419,000 CY, respectively. Volume dredged is directly related to the area of the remedy footprint. Note: error bars represent the range of volumes derived from applying the remedial alternatives to a suite of 100 possible interpolation results using the RI sediment data (conditional simulation).

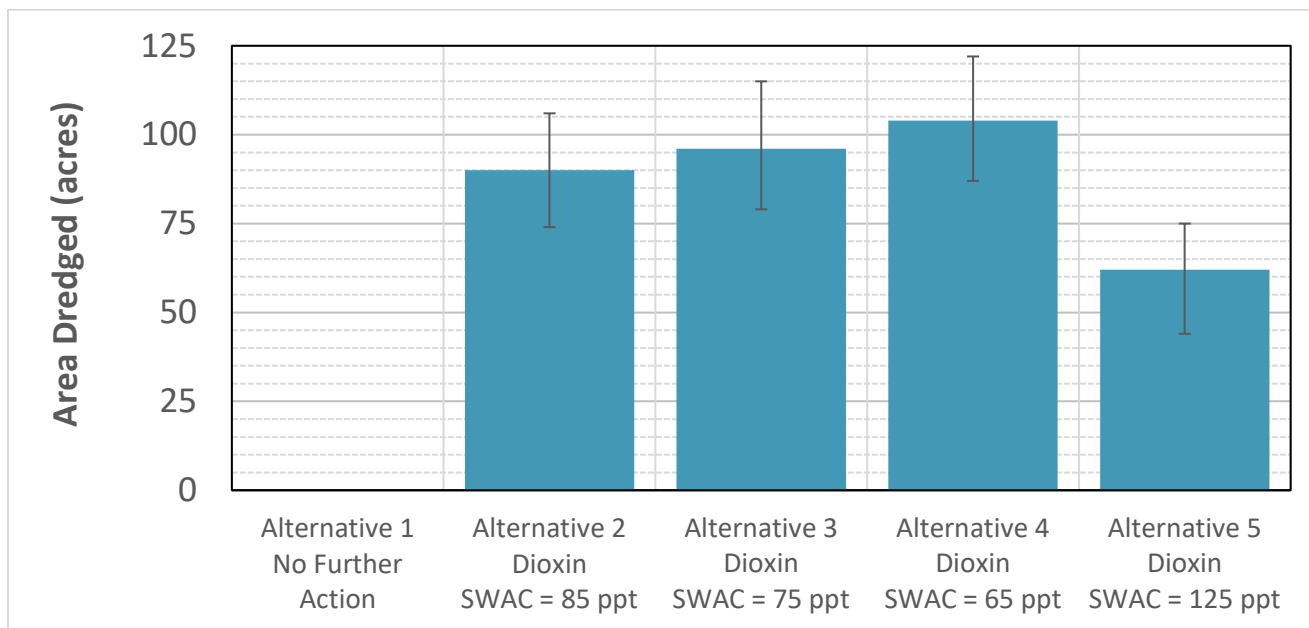


Figure 3. Area Dredged in Acres: Implementability decreases with larger areas, and cost increases with larger areas. Area dredged for Alternatives 2 through 4 ranges from 90 to 104 acres, respectively. Area dredged is related to the RALs required to achieve the target SWACs. The total area of the reach between RM 8.3 and 15 is approximately 252 acres. Note: error bars represent the range of areas derived from applying the remedial alternatives to a suite of 100 possible interpolation results using the RI sediment data (conditional simulation).

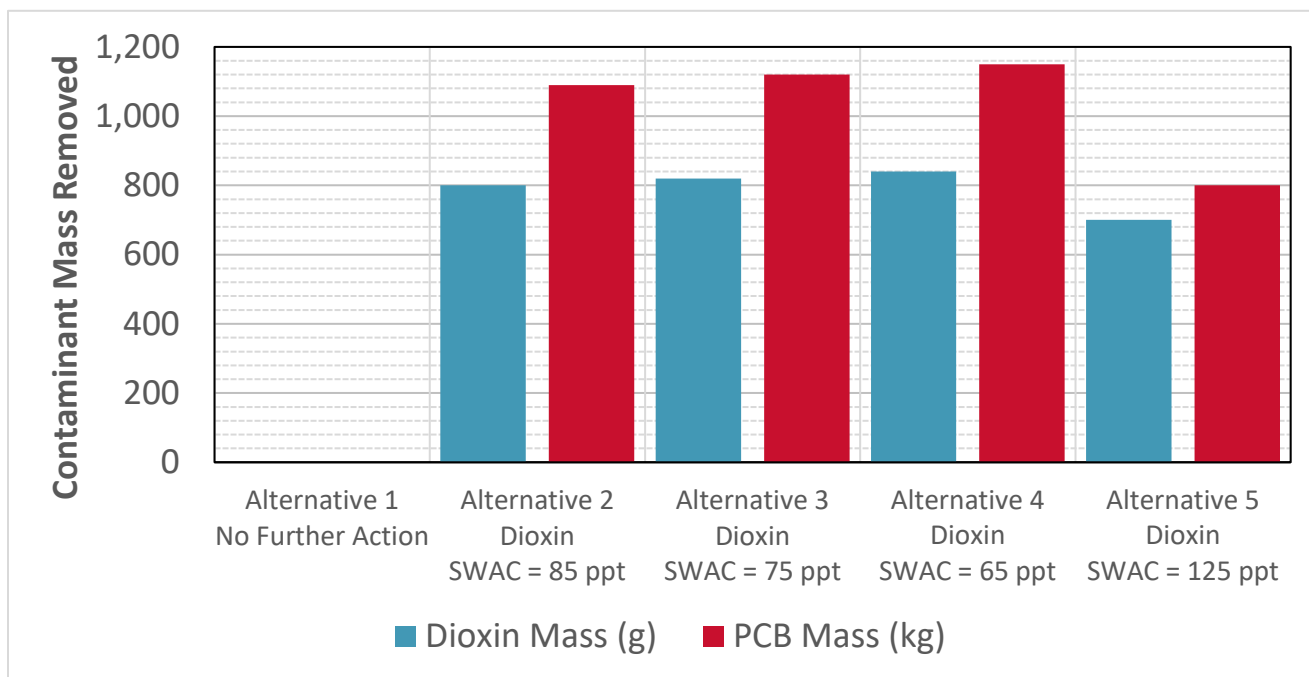


Figure 4. Contaminant Mass Removed: Reduction of toxicity, mobility, or volume through treatment increases with the mass removed. However, contaminant releases also increase with the mass removed. During the IR, increasing contaminant mass removed would increase fluxes to the reaches above RM 15 and below RM 8.3, and then reduce those fluxes in the long term. Contaminant mass removed is related to the volume dredged and the contaminant concentration averaged across the remedy footprint. The dioxin mass removed for Alternatives 2 through 4 ranges from 800 to 840 grams, respectively, and the total PCB mass removed for Alternatives 2 through 4 ranges from 1,090 to 1,150 kilograms, respectively.

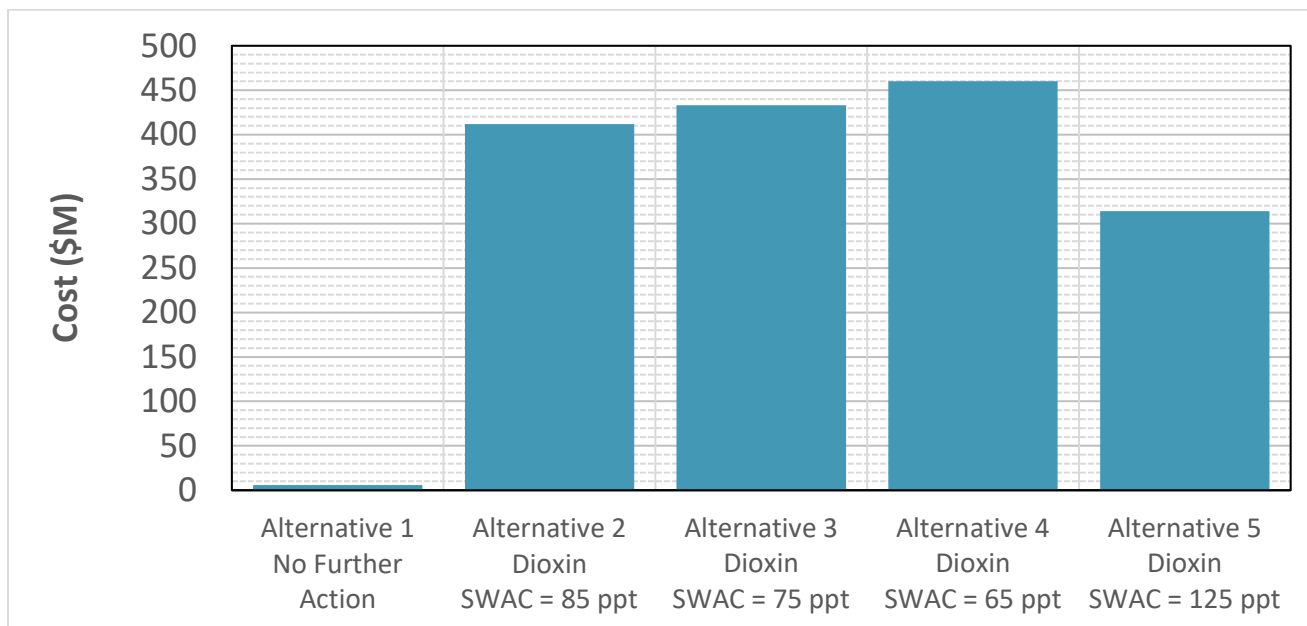


Figure 5. Remedy Cost: Remedy cost increases with increasing volume dredged. Remedy cost for Alternatives 2 through 4 ranges from \$412,000,000 to \$460,000,000, respectively.

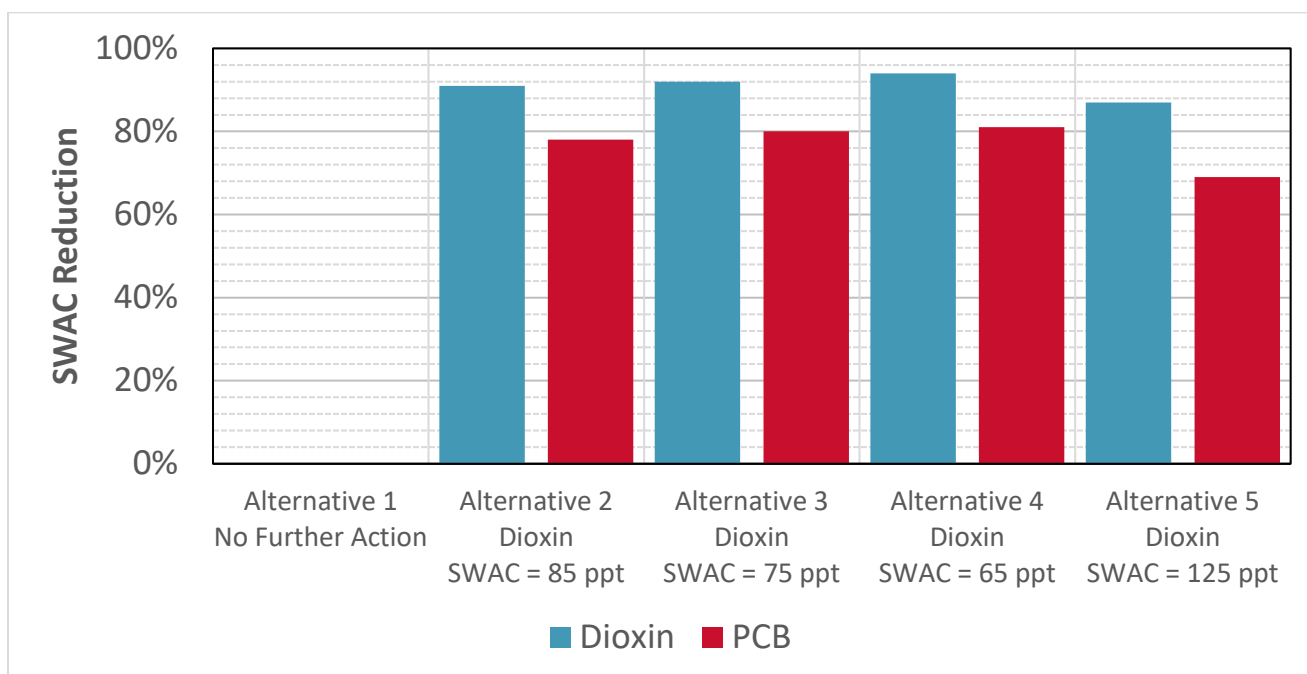


Figure 6. SWAC Reduction: SWAC reduction is dependent on the initial SWAC (calculated using concentrations resulting from interpolating the RI sediment data) combined with the target SWAC identified by each alternative and the additional reduction in SWAC resulting from applying RAO 2. The degree of progress toward protection of human health and the environment is related to the SWAC reduction. The dioxin SWAC reduction for Alternatives 2 through 4 ranges from 91% to 94%, respectively, and the total PCB SWAC reduction for Alternatives 2 through 4 ranges from 78% to 81%, respectively.

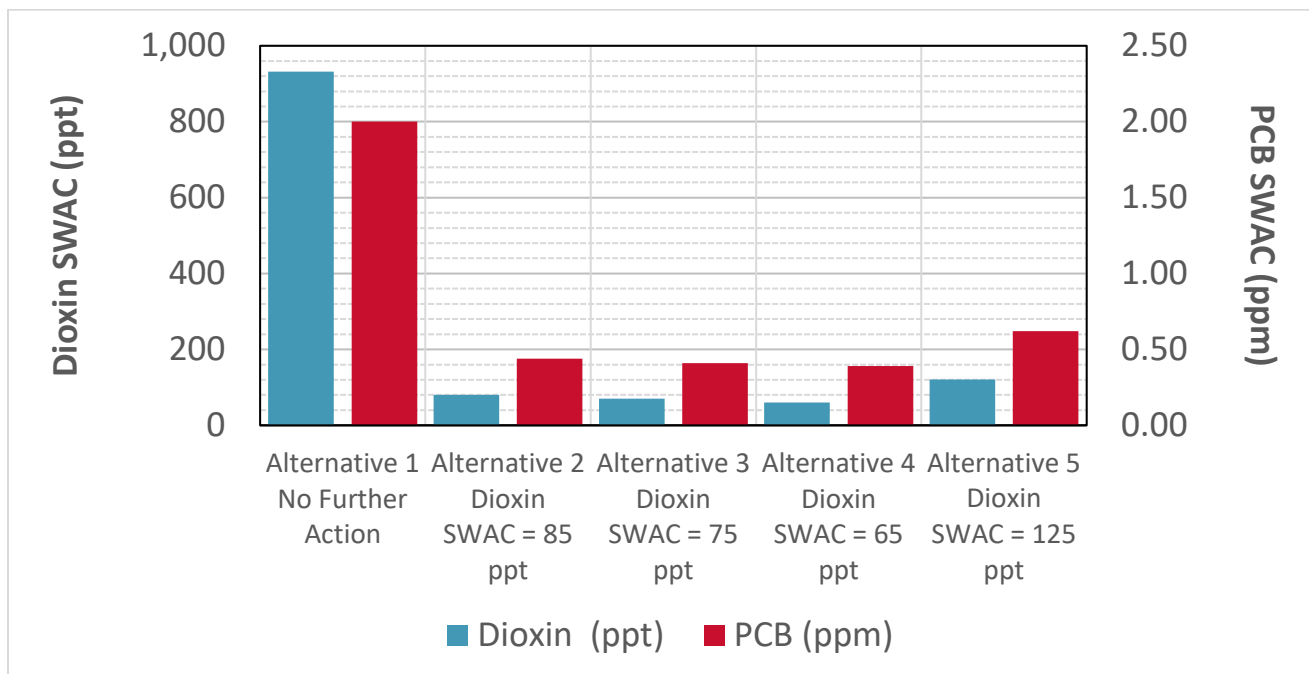


Figure 7. SWAC: SWAC is dependent on the target SWAC identified by the alternative and the additional reduction in SWAC resulting from applying RAO 2. Decreases in target SWAC result in lower RAL, which in turn result in increases in: SWAC reductions, remedial footprint areas, volumes dredged, costs, contaminant mass removals, contaminant mass releases, short-term contaminant fluxes, and remedy durations. Lower SWACs may incrementally increase progress toward protection of human health and the environment. The dioxin SWAC for Alternatives 2 through 4 ranges from 80 to 60 ppt, respectively, and the total PCB SWAC for Alternatives 2 through 4 ranges from 0.44 to 0.39 ppm, respectively.